

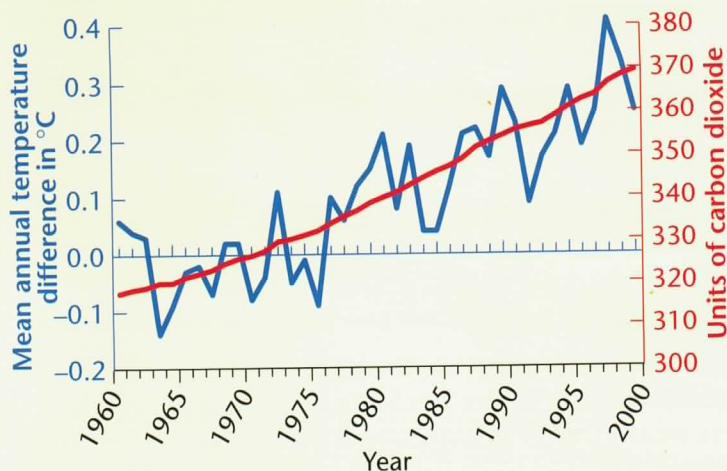
- The strength of evidence

More about global warming

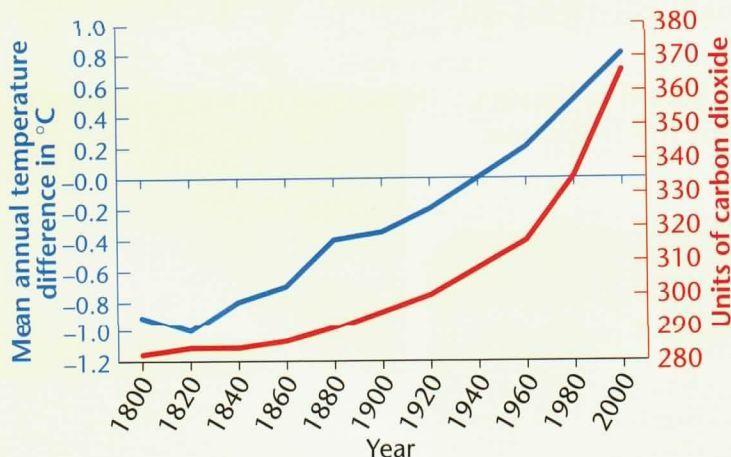
Henry and Leena are studying global warming. They want to look at evidence for the link between carbon dioxide in the air and the temperature of the Earth.

They found some data on the Internet that gave the percentage of carbon dioxide in the air and how the global temperature has changed over the 40 years up to the year 2000. They decided to plot graphs of these figures and compare them, to see if there was a pattern. Here are the graphs they made from the data.

At first glance, both carbon dioxide levels and the mean temperature seemed to have risen. But the pattern is not simple; the temperature graph shows a lot of variability from one year to the next. The temperature in the early 1960s also seemed to have dipped lower for a while, which looked like an **anomaly**.



- Suggest some other things that might affect global temperature, apart from carbon dioxide.
- In what way is the temperature data for the early 1960s anomalous?
- Even if the two graphs match exactly, would it prove that carbon dioxide causes the global warming?



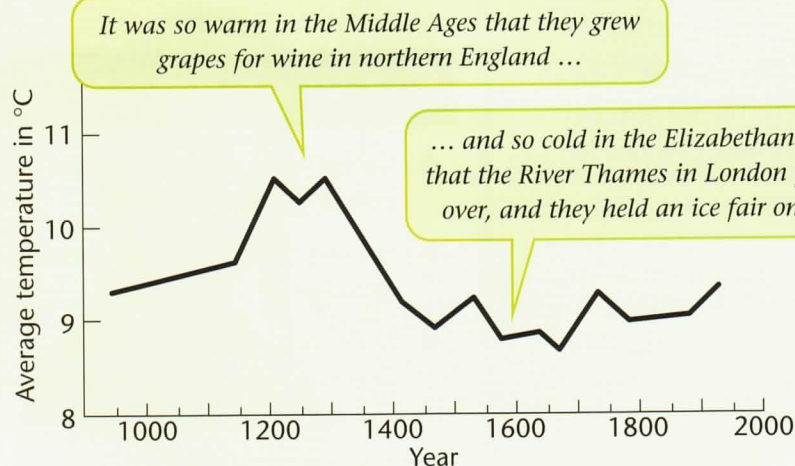
Going further back in time...

Henry and Leena decide that they need more evidence. They want to know if the warmer period in the early 1960s was just an anomaly or part of a wider pattern. They find this graph on the left that looks back 200 years. We have been burning fossil fuels for the last 200 years.

- What does this graph show about the link between carbon dioxide and temperature over the last 200 years?
- This graph shows a similar trend to the one Henry and Leena plotted. What makes the evidence stronger for a link between temperature and carbon dioxide?

Henry finds another graph showing just temperature for the last 1000 years.

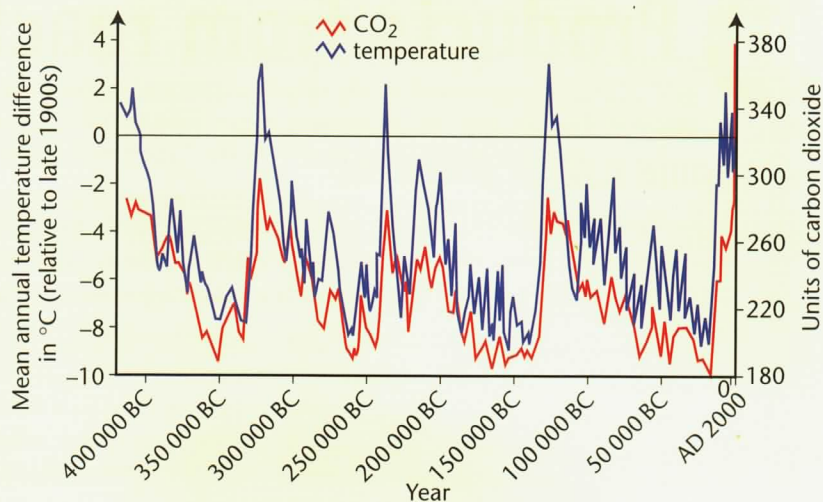
- Scientists think that carbon dioxide levels during the Middle Ages and Elizabethan Age stayed fairly constant. Does that fit the pattern of the last 200 years?



And don't forget the ice ages ...

Around 20 000 years ago, Britain was covered by ice and woolly mammoths roamed the country. So much water was frozen in icebergs that the sea level fell and what is now the English Channel was dry land.

Leena found another graph that showed data going back 250 000 years. Scientists have found a way to work out temperature and carbon dioxide levels from layers of ice in the Antarctic. The ice there has layer upon layer stretching back for a million years or so. The scientists drilled down through the ice, taking samples as they reached older and older layers.



- g** Describe the temperature pattern shown by the graph above. Which parts show ice ages?
- h** Look carefully at the variation in carbon dioxide level. Does it seem to change before or after the temperature? Does that support the idea that carbon dioxide is controlling the temperature change or not?
- i** The carbon dioxide level rises dramatically at the end of the graph. Why is that? As this change is so unusual, is it easy to predict what will happen next?

The graph shows that the Earth's climate has been changing for hundreds of thousands of years. There have been long, very cold ice ages followed by sudden rises in temperature. The carbon dioxide level has been varying naturally without our intervention, but has it been driving climate change or simply following it?

Leena and Henry realise that the Earth's climate is much more complicated than they thought. It could warm up, melt the ice and flood the land – or we could have another ice age. The one thing we can be certain of is that it is unlikely to stay constant. The role of carbon dioxide is not clear. But we have upset the balance by burning fossil fuels and driven the levels to new highs, which is probably not a good idea.

Questions

- 1 a** Plot your own line graphs from these figures for the last 200 years.

Year	1800	1820	1840	1860	1880	1900	1920	1940	1960	1980	2000
Carbon dioxide level in parts per million	282	284	285	286	290	296	302	310	321	340	370
Mean average temperature difference in °C	-0.9	-0.95	-0.8	-0.7	-0.45	-0.4	-0.2	0	0.05	0.3	0.7

- b** Describe the pattern each graph shows and compare the two trends.
- c** Now plot a scatter graph of carbon dioxide (x-axis) against temperature (y-axis). Draw a line of best fit through your points and describe any trend shown, including any anomalies.
- 2** An environmentalist group is campaigning to reduce greenhouse gas emissions from power stations. Their posters say they want to stop climate change. Write an article for your school magazine explaining why you support their campaign but doubt that they'll be able to achieve their stated aim.